

REMARKS/ARGUMENT

Claims 14-28 have been examined in the present application. Claims 14 and 19 have been amended hereby. Claims 14-19 and 21 have been rejected under 35 U.S.C. § 103(a) over Takahisa, et al. (Japanese Patent No. 08-222633) in view of Jeng (Japanese Patent No. 10-074755). Claims 20 and 22 have been rejected under Section 103 over Takahisa in view of Jeng and further in view of Bai, et al. (U.S. Patent No. 5,861,340). In light of the attached amendments and the below remarks, reconsideration of the present application is respectfully requested.

In paragraph 1 of the Office Action, claims 14-19 and 21 have been rejected under Section 103 over Takahisa in view of Jeng. Applicants respectfully traverse this rejection. As indicated in the attached Amendment, claim 14 has been amended to clarify that the hydrogen resident film is a silicon oxide film, and that the Si-H residue in the silicon oxide film is 61% or less. Support for this amendment to claim 14 can be found in the present specification in the table on page 15.

In contrast to the present invention as recited in claim 14, Takahisa forms an interlayer insulating film containing water content over a MOS transistor. Jeng covers a wiring layer 14 (not a MOS transistor) with a HSQ film 18. Jeng uses the HSQ film because of the easy reflow property of such a film. Neither Jeng nor Takahisa teach a positive utilization of a hydrogen supply. Neither Takahisa nor Jeng disclose the Si-H residue in the hydrogen resident film over a MOS transistor as is affirmatively cited in independent claim 14.

Furthermore, the Office Action states that it would have been an “obvious modification” of the structure of Takahisa to add the teachings of Jeng. Applicants respectfully disagree. The Federal Circuit has time and time again held that in order to combine references in an obviousness rejection, the Office must show the “suggestion, motivation or teaching in the prior art.” Karsten Manufacturing Corp. v. Cleveland Golf Co.,

242 F. 3d 1376 (Fed. Cir. 2001). In the present rejection, the Office Action has not shown this suggestion in the prior art, but rather has supplied the motivation itself. Applicants respectfully submit this is impermissible and that the Office Action has thus failed to make a prima facie case.

As neither Takahisa nor Jeng nor the combination of the two teach the present invention as is expressly recited in independent claim 14, withdrawal of the rejection of claim 14 and its dependent claims is respectfully requested.

Formerly dependent claim 19 has been re-written in independent form. Independent claim 19 requires that the hydrogen transmission preventing film is formed on the wiring layers so as to form air-filled grooves between adjacent wiring structures. Neither Takahisa nor Jeng teach or suggest such a structure. As discussed in the present specification at page 18, the air filling the groove has a specific dielectric constant of one. Thus, the present invention reduces the parasitic capacitance of the wiring, enabling a higher speed operation and/or widening of operation margin. Neither of these advantages of the present invention are taught or suggested by Takahisa or Jeng.

As neither Takahisa nor Jeng nor the combination of the two references teach the groove structure as affirmatively recited in independent claim 19, withdrawal of the rejection of claim 19 is respectfully requested.

On page 4 of the Office Action, claims 20 and 22-28 have been rejected under Section 103 over Takahisa in view of Jeng, further in view of Bai, et al. Applicants respectfully traverse this rejection. As claim 20 depends from claim 14 as discussed above, withdrawal of claim 20 is respectfully requested for the reasons described above with respect to claim 14.

Applicants respectfully submit that the Jeng, Takahisa and Bai references do not teach applying an interlayer insulating film including a hydrogen resident film over a MOS transistor having silicide layers on the source drain regions and the gate electrode, as affirmatively recited in claims 22-28.

Bai teaches silicide layers formed on the gate and the source drain regions of MOS transistor. However, Bai does not teach nor suggest the use of a hydrogen resident film as an interlayer insulating film covering a MOS transistor, as required by independent claim 22. Furthermore, Bai does not contain any teaching whatsoever with respect to the location of a hydrogen supply in the thermal process for reducing the interface energy levels or trap levels.

Takahisa discloses formation of an interlayer insulating film 18 containing water content over a MOS transistor. Jeng discloses forming an HSQ film 18 over a wiring 14. There is no teaching or suggestion in either of these references that a hydrogen resident film be formed over a MOS transistor having silicide layers on the gate, source and drain, as required by claims 22-28.

As recited in independent claim 22, an interlayer insulating film containing a hydrogen resident film is formed over a MOS transistor, having silicide layers on the gate, source and drain. In the process of forming the silicide layers by silicide (self-aligned-silicide) process, an interlayer insulating film containing a hydrogen resident film is formed to cover the silicide layers. A surface protection film is formed thereon. When the thermal anneal is accomplished of the device, hydrogen is supplied from the hydrogen resident film in order to reduce the interface trap levels.

As with the above discussion with respect to the rejection of claims 14 et al., Applicants respectfully submit that the Office Action has failed to establish a prima facie rejection of the present claims, as it has failed to show any suggestion, motivation or teaching in the prior art to make the combination of Takahisa, Jeng or Bai.

Applicants respectfully submit that none of the cited references, either alone or in combination, teach or suggest forming an interlayer insulating film containing a hydrogen resident film over a MOS transistor having silicide layers on the gate, source and drain, as affirmatively recited in independent claim 22 and its dependent claims. Withdrawal of the rejection of claims 22-28 is therefor respectfully requested.

As applicants have overcome each of the rejections contained in the present Office Action, each of the claims of the present application are currently in condition for allowance and such action is earnestly solicited.

Dated: December 18, 2002

Respectfully submitted,

By


Michael J. Scheer

Registration No.: 34,425

DICKSTEIN SHAPIRO MORIN &
OSHINSKY LLP

1177 Avenue of the Americas
41st Floor

New York, New York 10036-2714

(212) 835-1400

Attorneys for Applicant

APPENDIX A
Version With Markings To Show Changes Made
37 CFR 1.121(b)(iii) AND (c)(ii)

IN THE CLAIMS:

14. (Amended) A semiconductor device comprising:
a semiconductor substrate;
a MOS type transistor formed on said semiconductor substrate, said MOS type transistor including a source, a gate and a drain;
an interlayer insulating film formed on the semiconductor substrate, said interlayer insulating film covering said MOS type transistor and including a hydrogen resident film;
a wiring layer formed on said interlayer insulating film; and
a hydrogen transmission preventing film covering said MOS type transistor and said wiring layer, said hydrogen transmission preventing film is a silicon oxide film contains a SI-H residue of 61% or less.

19. (Amended) A semiconductor device [according to claim 14,] comprising:
a semiconductor substrate;
a MOS type transistor formed on said semiconductor substrate, said MOS type transistor including a source, a gate and a drain;
an interlayer insulating film formed on the semiconductor substrate, said interlayer insulating film covering said MOS type transistor and including a hydrogen resident film;
a wiring layer formed on said interlayer insulating film, wherein said wiring layer includes a plurality of adjacent wiring layers; and
a hydrogen transmission preventing film covering said MOS type transistor and said wiring layer, and wherein said hydrogen transmission preventing film [is formed as thick as can form a] forms an air filled groove between adjacent wiring layers.